REMARKS

Claims 1 through 9 and new Claim 11 are pending in the application.

Applicants acknowledge with gratitude the Examiner's apparent indication that Claim 9 is allowable in light of the art of record.

Claim 2 has been canceled, without prejudice or disclaimer to the filing of continuing applications thereon.

Claim 3 has been amended to correct a translational error by replacing the European term "oxyalkyl" with the US equivalent term "alkoxy."

Claim 6 has been amended to correct a grammatical error. Claim 6 has more particularly been amended to remove the first occurrence of "are selected from."

Claim 11 has been added to complete the record for examination and highlight advantageous embodiments of the invention.

Claim 11 is directed to advantageous embodiments of the invention in which the cellulose ether is moistened with 10 to 80 % water, based on the amount of cellulose ether, or suspended in 30 to 60% organic suspension medium, based on the amount of cellulose ether. Support for Claim 11 can be found in the Application-as-filed, for example on Page 5, lines 5 through 11.

Reexamination and reconsideration of this application, withdrawal of all rejections, and formal notification of the allowability of the pending claims are earnestly solicited in light of the remarks which follow.

Claim Objections

Claim 2 stands objected to as being in improper dependent form. Claim 2 has been canceled, without addressing the merits of the rejection and solely to advance prosecution of the above-referenced case.

Claim 6 stands objected to due to informalities. The first occurrence of "are selected from" has been removed, as kindly suggested by the Examiner.

Applicants respectfully request withdrawal of the foregoing objections.

Section 112 Rejection

Claim 3 stands rejected as indefinite over the recitation "oxyalkyl radical." Claim 3 has been amended to correct a translational error by replacing the European term "oxyalkyl" with the US equivalent term "alkoxy."

Applicant respectfully requests withdrawal of the foregoing rejection.

The Claimed Invention is Patentable in Light of the Art of Record

Claims 1 through 8 stand rejected over United States Patent No. 4,366,070 to Block. Claims 5 and 7 stand rejected over European Patent Application 0 252 649 A2 to Herron et al.

It may be useful to briefly consider the invention before addressing the merits of the rejection.

The production of aqueous solutions of cellulose ethers can be problematic. This applies, in particular, when the cellulose ether is present as fine powder having enlarged surface area. If

such a cellulose ether powder comes into contact with water, the individual granules swell and clump together to form relatively large agglomerates, the surface of which is thickened in a gel-like manner. However, depending on the mixing intensity, a certain proportion of completely unwetted cellose ether is situated in the interior of these agglomerates. Complete dissolution of these agglomerates can take up to 24 hours. Crosslinking of cellulose can be beneficial in the dissolution of cellulose ethers, for example by controlling swelling. Glyoxal is known for use in crosslinking cellulose ethers, as evidenced in the cited references.

In addition to dissolution, it is desirable for some applications to have a certain open time of a few seconds up to a plurality of hours. Open time, or else solvation delay (SD), means that after mixing the components, including cellulose ether, a certain time further passes until the cellulose ether increases the viscosity of the mixture, but then very abruptly. One means by which to provide such open time is by disrupting the crosslinked bonds within the cellulose ether.

Unfortunately, such a disruption in the crosslinking bonds may generate low molecular weight compounds within the aqueous solution of the cellulose ether. This is particularly problematic in the case of the conventionally used crossliking agents, such as glyoxal. More specifically, glyoxal has in recent years has been categorized as a mutagen and sensitizing substance.

It was thus an object of the present invention to develop a method by which cellulose ethers can be reversibly, i.e. temporarily, crosslinked and which succeeds without the use of low molecular weight generating compounds, such as glyoxal, and which further can be used in large-scale industrial production of crosslinked cellulose ethers without requiring complex and costly modifications or additional treatment steps, such as precipitation steps and the like.

Applicants respectfully submit that the foregoing references do not teach or suggest the claimed invention, either alone or in combination.

Block is generally directed to improved well drilling fluids. (Col. 1, lines 17 – 20). The drilling fluids of Block include a crosslinked hydroxyethyl cellulose (HEC) and a separate aluminum compound. (Col. 3, line 42 – 56). Block indicates that any of a generic laundry list of cross-linking agents is suitable. (Col. 5, lines 24 – 55). Block's working examples incorporate glyoxal, paraformaldehyde or epichlorohydrin. (Col. 9, lines 14 – 39). Block indicates that the cross-linking reactant is present in amounts ranging from 1 to 200 % of stoichiometry, based on the HEC. (Col. 5, lines 56 – 62). The crosslinking is broadly noted to be carried out in "an aqueous medium", which the working examples indicates is a 5 % solution of HEC. (Col. 5, lines 63 – 65 and Col. 9, lines 14 – 35). The cross-linked product may then recovered by conventional techniques, i.e. precipitation, filtration and drying. (Col. 5, line 68 – Col. 6, line 2).

Applicants respectfully submit that there would have been no motivation to have looked to Block, which is directed to drilling fluid compositions. However, even if Applicants had looked to Block (which they did not), the claimed invention would not result.

Block, disclosing dilute solutions of 5 % HEC, does not teach or suggest the claimed methods, in which the cellulose is not dissolved within the water or suspension medium. Block instead treats the HEC in very dilute form and thus the reaction is carried out in a homogeneous system, i.e. the HEC is dissolved in the water.

In contrast, the presently claimed process reacts cellulose ether with crosslinking agent in a heterogeneous system, in which the cellulose ether is not dissolved in water or a suspension medium, as reflected in Claim 1. Applicants respectfully submit that reacting the cellulose ether in a heterogeneous system provides distinct advantages over homogenous systems. For example, in heterogeneous systems there is no need to precipitate the crosslinked cellulose ether and drying is much faster and more economic. Applicants further respectfully submit that Block does not provide any motivation to carry out the crosslinking reaction in a heterogeneous system.

Nor does Block, teaching homogenous solutions specifically incorporating glyoxal, teach or suggest that such beneficial cellulose ether compositions that are not dissolved and further include chemical compounds containing at least one aldehyde group and at least one acid group would not generate low molecular weight compounds within the aqueous solution upon final dissolution of the cellulose ether, as provided by the claimed methods. In fact, one of the many benefits of the present invention is the avoidance of Block's glyoxal, which is classified as a mutagen and acts as a sensitizing agent, causing allergic reactions.

Block, expressly teaching up to 200 % of cross-linking agent in comparison to HEC, does not teach or suggest methods incorporating a reactive chemical compound in amounts ranging from 0.01 to 0.1 mol per mole of cellulose ether, as recited in Claim 5.

And Block, directed to very dilute 5% HEC solutions, most certainly does not teach or suggest advantageous methods in which the cellulose ether is moistened with 10 to 80 % water or suspended in 30 to 60 % organic suspension medium, as recited in new Claim 11.

Accordingly, Applicants respectfully submit that the presently claimed method is patentable in light of Block, considered either alone or in combination with the remaining art of record.

Claims 5 and 7 are likewise patentable in light of Herron.

Herron discloses a method for permanently crosslinking cellulose fibers. (Page 3, line 37). In this method intra-fiber crosslinking is achieved, but not an inter-fiber crosslinking. The cellulose may be selected from any of a number of natural sources, and the lap fibers are mechanically processed to separate the individual fibers prior to processing. (Page 4, lines 3 thorough 11). Herron expressly cautions, however, that the damage to the fibers during separation is to be "minimized." (Page 4, line 10 and Page 5, lines 4 - 5).

Herron generically notes that suitable crosslinking agents may be selected from any of a number of dialdehydes and the like. (Pg. 3, lines 44 - 46). Herron's working examples incorporate glutaraldehyde. (Page 15, line 5 – Page 16, line 42). Herron expressly teaches that "unexpectedly good" results were obtained for fibers having between 0.5 and 3.5 mole % crosslinking agent. (Page 4, lines 35 – 39). In fact, Herron expressly teaches use of 0.5 to 3.5 mole % crosslinking agent on multiple occasions. (Page 7, lines 56 – 57).

In contrast to the recited temporary crosslinks, Herron states that his crosslinkers provide "stable crosslink bonds," which he describes as "desirable." (Page 4, lines 55 – 57). In fact, Herron's fibers retain their crosslinked state even after the multiple immersion/wetting steps used during absorbent pad formation. (Page 10, line 46 – Page 11, line 15). Herron, evidencing conventional wisdom, teaches the presence of residual crosslinking agents within its resulting nonwovens, which he further notes as problematic. (Page 3, lines 15 – 26). Herron goes on to disclose that his fibers must be washed to remove such residual crosslinking agent. (Page 11, lines 41 – Page 12, line 6).

In order to keep the fibers in substantially individually form, the reaction is carried out in a slurry, as correctly noted within the Office Action. (Page 6, lines 11 – 12 and Page 9, lines 1 – 7). As further noted within the Office Action, Herron's Working Example indicates a total processing time of 65 minutes to obtain suitable cross-linked fibers. (Page 15, lines 14 – 20). The crosslinked fibers are used to produce absorbent pads with improved absorbency characteristics in comparison to pads formed from conventional, uncrosslinked fiber. (Page. 1, lines 35 – 39 and Page 13, lines 1 - 2).

Applicants respectfully submit that there would have been no motivation to have looked to Herron, which is directed to permanently cross-linked cellulose fibers for use in absorbent pads. However, even if Applicants had looked to Herron (which they did not), the claimed invention would not have resulted.

Herron, directed to permanently crosslinked cellulose, does not teach or suggest the recited temporary crosslinks.

Herron also fails to teach or suggest the recited cellulose ethers, much less temporarily crosslinked cellulose ethers. Applicants respectfully submit that cellulose ethers have a smaller number (less than half) of the free hydroxy groups which could take part in a crosslinking reaction (the other hydroxy groups are etherified and hence no longer reactive), thus there would have been no motivation by Herron to have used them. And there most certainly would have been no motivation to have formed the recited temporary crosslinked bonds from the recited cellulose ethers in light of Herron.

Nor does Herron, directed to fibers, teach or suggest such cellulose ether having lump-free stirrability and solvation delay, as the foregoing recited terminology is associated with pulverulent products.

Herron, generically noting a range of crosslinkers and specifically teaching glutaraldehyde, further does not teach or suggest reacting cellulose ether with chemical compounds containing at least one aldehyde group and at least one acid group. Herron instead teaches the use of conventional crosslinkers, e.g. glutaraldehyde, as evidenced by his required removal of residual crosslinkers.

And Herron, expressly teaching 0.5 to 3.5 mole % crosslinking agent on multiple occasions, most certainly does not teach or suggest the incorporation of chemical compounds containing at least one aldehyde group and at least one acid group in amounts ranging from 0.01 to 0.1 mol per mole of cellulose ether, as recited in Claim 5. Nor would there have been any motivation to have selected such a range, thus imparting the recited temporary crosslinks, in light of Herron. As noted above, Herron is instead directed to permanently crosslinked fibers.

Herron, teaching a total reaction time of 65 minutes, also does not teach or suggest admixing over a time period as short as 10 min, as recited in Claim 7. Nor would there have been any motivation to have done so based upon the permanent crosslinking imparted by Herron.

Accordingly, Applicants respectfully submit that Claims 5 and 7 cannot be rendered obvious in light of Herron, considered either alone or in combination with the remaining art of record.

CONCLUSION

It is respectfully submitted that Applicants have made a significant and important contribution to the art, which is neither disclosed nor suggested in the art. It is believed that all of pending Claims 1 and 3 through 9 and 11 are now in condition for immediate allowance. It is requested that the Examiner telephone the undersigned if any questions remain to expedite examination of this application.

It is not believed that extensions of time or fees are required, beyond those which may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time and/or fees are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required is hereby authorized to be charged to Deposit Account No. 50-2193.

Respectfully submitted,

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